

**Assessment Annotations
for the Curriculum Frameworks**

Science

Grades 3, 7, and 10



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SCIENCE ASSESSMENT ANNOTATIONS

FOR THE

SCIENCE CURRICULUM FRAMEWORKS

The benchmark statements in the Science Curriculum Frameworks are at the second, fourth, eighth, and twelfth grades while the science portion of the Missouri Assessment Project will be given at the third, seventh, and tenth grades. In order to provide assistance in curriculum alignment to administrators, curriculum directors, and teachers concerning what is or is not “fair game” content for the science assessment, the attached document was developed by practicing classroom teachers and administrators.

This document includes the left-hand column (“What All Students Should Know”) and the center column (“What All Students Should Be Able To Do”) from the Science Curriculum Frameworks. The third column contains annotations about each benchmark as provided by several teacher work groups and is intended to provide guidance to **CTB/McGraw-Hill**, the assessment contractor. The first strand of the framework (Scientific Inquiry) was considered fair game at all grade levels and is not included in this document.

In the K-4 range, all of the benchmarks at grade two are “fair game” for assessment at grade 3. The benchmarks at grade four will have the words “Grade 3 state assessment” in the third column to denote a benchmark is “fair game” content or the words “Beyond grade 3 state assessment” to denote a benchmark that will not be considered at grade 3. Likewise, at the 5-8 range, the words “Grade 7 state assessment” or “Beyond grade 7 state assessment” will provide guidance. In the 9-12 range, the benchmarks will have annotations that say “Grade 10 state assessment” or “Beyond grade 10 state assessment.” Some of the annotations will be more specific and are self-explanatory. Not all benchmarks identified here as “fair game” for a state test will show up on the test in any given year.

Also, teacher work groups met in late **1996** and early 1997 to decide which of the seventy-three Show-Me Standards should be assessed on a statewide basis through the science performance assessment instrument. These teacher groups identified the following list of standards:

All of the Science Knowledge Standards

Performance Standards, Grade 3 :	1.3, 1.5, 1.6, 1.8, 1.10, 2.1, 3.5, 4.1
Performance Standards, Grades 7 & 10:	1.1, 1.3, 1.5, 1.6, 1.7, 1.10, 2.1, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 4.1

These standards will be the focus of the performance event of the science portion of the Missouri Assessment Project.

II. SCIENTIFIC RELEVANCE-----ASSESSMENT NOTES (Show-Me Standards, Science 8)

A. The Nature of Technology

B. Historical Perspective

C. Science as a Human Endeavor

K-12 Content overview:

As long as there have been people, there has been technology. Indeed, the techniques of shaping tools are taken as the chief evidence **of the beginning of** human culture. On the whole, technology has been a **powerful** force in the development of civilization, all the more so as its link with science **has** been forged. Science and technology--like language, ritual, values, commerce, and the arts--are an intrinsic parts of a cultural system that both shape and reflect the system's values. . Consider, for example, how new ideas are limited by the context in which they are conceived; are often rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly, through contributions from many different investigators. Historical episodes such as Galileo's efforts to change perceptions of Earth's place in the universe, Newton's demonstration that the same laws of motion apply **in the heavens and** on Earth, Lyell's careful documentation of the age of the Earth, and Pasteur's identification of infectious disease with microscopic organisms are all concrete examples of how scientific theory and technology interacts with social and political realities within a specific period of time. these examples also illustrate the power of individuals to conceptualize and change our understanding of the world around us

Even in today's world, technology is a complex social enterprise that includes not only research, design, and crafts but also finance, manufacturing, management, labor, marketing, and maintenance. In the broadest sense, technology extends our abilities to change the world: to cut, shape, or put together materials; to move things from one place to another; to reach farther with our hands, voices, and senses. We use technology to try to change **the world to suit us** better. The results of changing the world are often complicated and unpredictable. They can include unexpected benefits, unexpected costs, **and** unexpected risks. Anticipating the effects of technology is, therefore, as important as advancing its capabilities.

(Benchmarks for Science Literacy, AAAS 1993)

II. Scientific Relevance A. The Nature of Technology

What All Students Should Know	What All Students Should Be Able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 2, all students should know that</i></p> <p>1. Tools that have been invented affect all areas of life.</p>	<p><i>By the end of grade 2, all students should be able to</i></p> <p>a. develop realistic strategies and use various objects to solve simple environmental or social problems encountered in school or community. (3.1; 3.2; 3.3)</p>	Grade 3 state assessment
<p>2. When a group of people want to build something or try something new, they should try to figure out ahead of time how it might affect all living things and environments.</p>	<p>a. predict, analyze, and evaluate the potential effects of technological solutions to simple problems on other people or the environment, considering such issues as costs, benefits, and consequences. (3.6; 3.7; 3.8)</p>	Grade 3 state assessment
<p><i>By the end of grade 4, all students should know that</i></p> <p>3. Technology extends the ability of people to change the way things work,</p>	<p><i>By the end of grade 4, all students should be able to</i></p> <p>a. develop several alternative strategies to solve existing and potential technical problems, analyze and evaluate alternatives by comparing strengths (such as safety or ease of use) and weaknesses (such as cost or appearance). (3.6; 3.7; 3.8)</p>	Grade 3 state assessment, but only simple design questions
<p>4. Technological solutions to problems often have drawbacks as well as benefits.</p>	<p>a. predict possible negative consequences, to people, other organisms, or the environment, of technological solutions to specific problems. (3.6; 3.7; 3.8; 4.7)</p>	Beyond grade 3 state assessment

II Scientific Relevance B. Historical Perspective

What All Students Should Know	What All Students Should Be Able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 2, all students should know that</i></p> <p>1. Throughout human history, technological innovations have played an important role in improving the quality of life.</p>	<p><i>By the end of grade 2, all students should be able to</i></p> <p>a. investigate, discuss, and raise questions about the past, and possible future, contributions of science and technology to individuals and society. (1.2; 1.9; 2.3; 2.4; 3.4; 3.6)</p>	Grade 3 state assessment
<p><i>By the end of grade 4, all students should know that</i></p> <p>2. Advances in science and technology are occurring at a faster rate today than in the past</p>	<p><i>By the end of grade 4, all students should be able to</i></p> <p>a. identify some reasons/causes for recent increases in technological advances. (1.2; 4.1)</p>	Beyond grade 3 state assessment

II Scientific Relevance C. Science as a Human Endeavor

What All Students Should Know	What All Students Should Be Able To Do	Grade 3 Assessment Notes
<p><i>By the end of grade 2, all students should know that</i></p> <p>1. Science is a way to solve problems; everybody can do science activities, discover some things about nature, and invent things and ideas.</p>	<p><i>By the end of grade 2, all students should be able to</i></p> <p>a. work with a group to solve a problem, giving due credit to the ideas and contributions of each group member. (2.3; 3.6; 4.4; 4.6)</p>	Grade 3 state assessment
<p><i>By the end of grade 4, all students should know that</i></p> <p>2. Science requires many different kinds of activities, involving men and women of all ages and backgrounds.</p>	<p><i>By the end of grade 4, all students should be able to</i></p> <p>a. recognize the various ways in which science and technology impact on all career and occupational areas (4.3; 4.8)</p>	Beyond grade 3 state assessment

II. Scientific Relevance A. The Nature of Technology

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<p><i>By the end of grade 8, all students should know that</i></p> <p>1. The issues related to science, technology, and society are often complex and involve risk/benefit trade-offs.</p>	<p><i>By the end of grade 8, all students should be able to</i></p> <p>a. analyze, evaluate, and communicate both benefits and possible risks to health, society, and the environment associated with investigations and technological advances reported in the media. (1.1; 1.2; 1.7, 1.8; 2.1; 2.2; 2.3; 3.1; 3.5; 3.6; 3.8; 4.1; 4.3; 4.4; 4.6)</p>	Grade 7 state assessment
<p>2. Breakthroughs in science often lead to advances in technology and improved technological equipment leads to more accurate data collection in scientific inquiry.</p>	<p>a. identify and analyze ways in which advances in science and technology have affected each other and society. (1.1; 1.2; 1.6; 1.7; 1.9; 3.8)</p>	Grade 7 state assessment

II Scientific Relevance B. Historical Perspective

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<p><i>By the end of grade 8, all students should know that</i></p> <p>1. Important contributions in science have been made by many different people, in different cultures, and at different times. Their places of work include offices, classrooms, laboratories, farms, factories, and natural field settings everywhere.</p>	<p><i>By the end of grade 8, all students should be able to</i></p> <p>a. identify the background qualifications and training that is needed in order to have careers related to science and technology. (4.8)</p>	Grade 7 state assessment
<p>2. Some people (e.g., women and minorities) have sometimes been discouraged or denied the opportunity of participating in science because of education or employment prejudices and restrictions.</p>	<p>a. describe some of the funding sources which can be used to finance education and training in science and technology (1.2; 1.4; 1.7)</p>	Grade 7 state assessment

II Scientific Relevance c. Science as a Human Endeavor

What All Students Should Know	What All Students Should Be Able To Do	Grade 7 Assessment Notes
<p><i>By the end of grade 8, all students should know that</i></p> <p>1. Science ethics require that scientists must not knowingly subject coworkers, students, human research subjects, the neighborhood, or the community to health or property risks without their knowledge and consent.</p>	<p><i>By the end of grade 8, all students should be able to</i></p> <p>a. evaluate possible risks to classmates, research subjects, or the community associated with their own independent investigations. (1.2; 1.4; 1.7, 1.10; 4.3; 4.4; 4.7)</p>	Grade 7 state assessment
<p>2. Social, cultural, environmental, and economic factors all influence which science and technology will be undertaken and used. Society and the environment are directly influenced by the discoveries of science and products of technology.</p>	<p>a. analyze and evaluate the economic, political, social, ethical, and aesthetic constraints that might affect progress with specific science or technology endeavors. (3.1; 3.4; 3.5; 3.6; 3.8; 4.1)</p>	Grade 7 state assessment

II Scientific Relevance A. The Nature of Technology

What All Students Should Know	What All Students Should Be Able To Do	Grade 10 Assessment Notes
<p><i>By the end of grade 12, all students should know that</i></p> <ol style="list-style-type: none"> 1. Social and economic forces, such as consumer acceptance, patent laws, the federal budget, regulations, media attention, and economic competition, influence the direction of progress of science and technology. 	<p><i>By the end of grade 12, all students should be able to</i></p> <ol style="list-style-type: none"> a. discuss the scientific, technological ,and political aspects of major challenges to society. Describe how each of these aspects influences public policy formulation in dealing with the challenges. (2.3; 2.4; 4.1; 4.3; 4.7) 	Grade 10 state assessment
<ol style="list-style-type: none"> 2. Human beings have a huge impact on other species, their environments, and technology. These include reducing the amount of habitat available, interfering with food sources, changing the temperature and chemical composition of habitats, introducing foreign species, and altering organisms directly through selective breeding and genetic engineering. 	<ol style="list-style-type: none"> a. analyze and evaluate how specific technological solutions may impact the environment in areas such as habitat loss, disruption of the food web, and temperature and chemical changes. (1.1; 1.2; 1.6; 1.7; 3.1; 4.1) 	Grade 10 state assessment

II Scientific Relevance B. Historical Perspective

What All Students Should Know	What All Students Should Be Able To Do	Sample Learning Activities
<p><i>By the end of grade 12, all students should know that</i></p> <ol style="list-style-type: none"> 1. Scientific theories are developed based on the body of knowledge that exists at any particular time. To find what is real true, scientists to test the validity of these theories and as a result the mysteries of nature are continuously probed and explained as new theories are created and old theories discarded. 	<p><i>By the end of grade 12, all students should be able to</i></p> <ol style="list-style-type: none"> a. identify and analyze theories that are currently being questioned, and compare them to new theories that have emerged to challenge the older ones. (1.2; 1.5;1.6;1.7; 1.9; 2.4; 3.7; 4.1). 	Grade 10 state assessment

What All Students Should Know	What All Students Should Be Able To Do	Sample Learning Activities
<p><i>By the end of grade 12, all students should know that</i></p> <p>2. The history of scientific thought spanned many cultures and centuries. The early Egyptian, Greek, Chinese, Hindu, and Arabic cultures are responsible for many scientific and mathematical ideas and technological inventions. Modern science is based on traditions of thought that came together in Europe about 500 years ago. All cultures now contribute to that tradition.</p>	<p><i>By the end of grade 12, all students should be able to</i></p> <p>a. identify and analyze various scientific concepts, inventions, and technological innovations that have been developed by different cultures from around the world. Discuss the influence of prevailing contemporary thought on the acceptance of these concepts, inventions, and innovations by other scientists and society. (1.2; 1.5; 1.6; 1.7; 1.8; 1.9; 2.1; 2.2; 2.3; 2.4; 4.1)</p>	<p>Grade 10 state assessment</p>

II Scientific Relevance c. Science as a Human Endeavor

What All Students Should Know	What All Students Should Be Able To Do	Grade 10 Assessment Notes
<p><i>By the end of grade 12, all students should know that</i></p> <p>1. Scientists make mistakes like all people. Deliberate deceit, however, is rare and is likely to be exposed eventually by the scientific enterprise itself.</p>	<p><i>By the end of grade 12, all students should be able to</i></p> <p>a. identify, discuss, and respond thoughtfully to information from credible sources, such as scientists making claims in their areas of expertise, and from sources of questionable credibility, such as people whose own personal, institutional, or community interests are at stake. (1.5; 1.7; 1.8; 2.1; 2.2; 2.3)</p>	<p>Grade 10 state assessment</p>
<p>2. Research funding comes from various federal government agencies, industry, and private foundations. Research grant proposals are written to promote research that is relevant, well-designed, cost efficient, and well-supported by previous research.</p>	<p>a. analyze a scientific research grant proposal and defend or dispute, in an organized and convincing way, sections that promote the proposed research. (1.2; 1.5; 1.7; 1.8; 2.1; 2.2; 2.4; 4.1)</p>	<p>Beyond grade 10 state assessment</p>